Quiz 7

1. (Short answer) Suppose Charlie and Taylor decide to compete in a two-person foot race. The odds of Charlie beating Taylor in the foot race are 9 to 1 (odds = 9). Compute the **probability** that *Taylor* wins the foot race.
2. (Short answer) Suppose I am interested in predicting the probability that Star Wars characters are human based on their age in years. I fit both a linear regression model and a logistic regression model with binary human status as my outcome, and age as a single quantitative predictor. I plot my data in a scatterplot, and include both fitted regression lines on my plot below, with the blue line being from the linear regression and the red line being form the logistic regression.

Chart, line chart

Description automatically generated

The character Yoda is recorded as 896 years old (the oldest character in my dataset). Should I use the linear regression model or logistic regression model for predicting the probability that characters are human based on their age? Justify your answer.

1. (Short answer) Suppose I am interested in the association between playing video games as a child and playing video games as an adult. I take a random sample of adults and ask them two questions: (1) Did you play video games as a child? (Binary, Yes/No), and (2) Do you play video games as an adult? (Binary, Yes/No)

I summarize my data in the following table:

|  |  |  |
| --- | --- | --- |
|  | Video Games as Child: Yes | Video Games as Child: No |
| Video Games as Adult: Yes | 10 | 0 |
| Video Games as Adult: No | 7 | 15 |

For each of the following two questions, either calculate the probability/odds, or explain why you cannot calculate the probability/odds:

What is the probability of not playing video games as an adult, for individuals who did not play video games as children?

What are the odds of not playing video games as an adult, for individuals who did not play video games as children?

1. (Multiple choice) Your friend is reading a scientific article that states, "The odds of completing your doctorate degree are 2.3 times higher for people who have dogs than for people who have cats (95% CI: (0.9, 5.2))." Which of the following is correct?
2. At a significance level of 0.05, we cannot reject the null hypothesis that the odds of completing your doctorate degree are the same for cat and dog owners.
3. At a significance level of 0.05, we can reject the null hypothesis that the odds of completing your doctorate degree are the same for cat and dog owners.
4. I have data on whether having a standing desk (binary) is associated with back pain (binary). Based on my data, I estimate that the risk ratio of back pain comparing people who do and do not have a standing desk is 0.7 . Which of the following could be the odds ratio of back pain comparing people who do and do not have a standing desk?
   1. 0.4
   2. 0.9
   3. 1.1
   4. 1.4
5. (Multiple choice) Suppose I am interested in the association between breast cancer (yes/no) and family history of breast cancer (yes/no). Specifically, I am interested in whether the probability of having breast cancer is different for individuals with a family history of breast cancer vs. those without. Which type of regression analysis will answer my statistical question using a single regression coefficient?
6. Linear regression
7. Logistic regression
8. Using the HIV dataset, I fit the following logistic regression model with “results” (whether or not someone chooses to go get their test result) being the outcome and “incentive” (whether or not someone receives an incentive) being the predictor of interest. The variable “far” is defined as whether or not someone was over 3 kilometers away from the place they needed to go to receive their test results. Based on the output below and your knowledge of the dataset, what role does “far” play in our analysis?

Call:

glm(formula = results ~ incentive \* far, data = HIV)

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 0.352941 0.019001 18.575 <2e-16 \*\*\*

incentive 0.451279 0.021572 20.919 <2e-16 \*\*\*

far -0.063879 0.041852 -1.526 0.127

incentive:far 0.004638 0.047046 0.099 0.921

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

* 1. Effect modifier
  2. Confounder
  3. Precision Variable
  4. More than one of these options are correct

1. Using the HIV dataset, I fit the following logistic regression model with “results” (whether or not someone chooses to go get their test result) being the outcome and “incentive” (whether or not someone recieves an incentive) being the predictor of interest. Using the output below, what is the approximate estimated odds ratio of getting results for people who do and do not receive and incentive, comparing two groups that are both over 3 kilometers away from where they go to get their results.

Call:

glm(formula = results ~ incentive \* far, data = HIV)

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 0.352941 0.019001 18.575 <2e-16 \*\*\*

incentive 0.451279 0.021572 20.919 <2e-16 \*\*\*

far -0.063879 0.041852 -1.526 0.127

incentive:far 0.004638 0.047046 0.099 0.921

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

* 1. 1.58
  2. 1.57
  3. 2.11
  4. 2.10

1. (True/False) Using the HIV dataset, I fit the following logistic regression model with “results” (whether or not someone chooses to go get their test result) being the outcome and “incentive” (whether or not someone receives an incentive) being the predictor of interest. True or False: The intercept of this model is scientifically interpretable.

Call:

glm(formula = results ~ incentive \* far, data = HIV)

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 0.352941 0.019001 18.575 <2e-16 \*\*\*

incentive 0.451279 0.021572 20.919 <2e-16 \*\*\*

far -0.063879 0.041852 -1.526 0.127

incentive:far 0.004638 0.047046 0.099 0.921

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

1. (True/False) I am rolling two dice. The probability that I rolled a 2 given that the sum of the two rolls was 3 is an unconditional probability.